DOCUMENT RESUME

ED 171 518 SE 027 528

AUTHOR Mullis, Ina V. S.
TITLE Effects of Home and School on Learning Mathematics, Political Knowledge and Political Attitudes.
INSTITUTION Education Commission of the States, Denver, Colo. National Assessment of Educational Progress.
PUB DATE Apr 79
NOTE 72p.; Paper presented at the annual meeting of the American Educational Research Association (San Francisco, California, April 8-12, 1979); Some tables marginally legible

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Achievement; *Educational Environment; *Educational Research; Elementary Secondary Education; *Family Environment; Learning; *Mathematics Education; *Physical Environment; Political Attitudes; Political Science

ABSTRACT

Data collected in 1976 by the National Assessment of Educational Progress (NAEP) were analyzed by using a path analysis of clusters of variables combined into single composite variables. Investigated were the relative importance and effect of three clusters of variables (home environment variables, community and school environment variables, and school instructional variables) on educational achievement in the areas of mathematics, political knowledge, and socio-political attitudes. The effect of school on learning was substantially larger than the effect of type of school and school program and tended to be quite high relative to the effect of home on learning. (MP)

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EFFECTS OF HOME AND SCHOOL ON LEARNING MATHEMATICS, POLITICAL KNOWLEDGE AND POLITICAL ATTITUDES[1]

SESSION #1.01

by

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National Assessment of Educational Progress
The Education Commission of the States

April 1979

[1]Abstracted from Ina Mullis, "Effects of Home and School on Learning Mathematics and Political Knowledge and Attitudes" (Ph.D. dissertation, University of Colorado, 1978).

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EFFECTS OF HOME AND SCHOOL ON LEARNING MATHEMATICS, POLITICAL KNOWLEDGE AND POLITICAL ATTITUDES[1]

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Introduction

The 1966 release of Equality of Educational Opportunity, by James Coleman et al. indicated that differences among schools contribute little to differences in what students learn. In fact, the report findings suggested that, compared to home background, school had almost a negligible effect on differences in achievement.

When one considers the question of naturally occurring variance, the finding that school is of relatively less importance than prior student abilities in influencing achievement is not as surprising as it might appear. Children possess a wide range of inherited abilities and are products of extremely varied pre-school environments; the variation in learning opportunities provided by schools is quite small in comparison.

Still, many found the report results to be contrary to common sense. That family background accounts for a substantial amount of the variation in achievement has not been seriously questioned, but Jencks (1972a) as well as others (Bowles and Levin, 1968) were not prepared for the small amount of variance in achievement explicitly accounted for by variations in facilities and curricula. While one would expect student background to be a powerful determinant of pupil achievement, it might also be anticipated that school characteristics would have a significant influence on performance levels.

Since the results were not as expected, controversy arose over technical aspects of the study. The findings were not, and are not, considered definitive in any sense. Disagreements over purpose, procedure and methodology abound. Some of the most notable critiques are those by Bowles and

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Levin (1968), Cain and Watts (1970), Hanushek and Kain (1972) and Jencks (1972b). It has been maintained that the data were defective because of high non-response rates and because of the inaccuracy, inadequacy and irrelevance of the information collected. It has also been suggested that if the data were analyzed correctly, they might not support the conclusions reached.

Critics, who scrutinized the regression analyses used to examine the relation of student characteristics and school resources to scholastic achievement, found the model simplistic and the implementation of the analyses improper in view of the conclusions reported. In addition to those mentioned earlier, Smith (1972), Coleman (1972) and Mayeske et al. (1973) provide detailed explanations of the problems summarized in the following discussion.

The basic issue is that of how jointly explained variance should be partitioned among explanatory variables. The study used the basic additive model

$$A_i = b_o + b_H H_i + b_B B_i + b_T T_i + e_i$$

where

A_i = the Achievement of individual i

H_i = the Home Background experiences of individual i

B_i = the characteristics of the Student Body in the school individual i attends

F_i = the Facilities and Curriculum in the school individual i attends

T_i = the characteristics of the Teachers in the school individual i attends

e_i = the error, or residual portion, of A_i that cannot be explained by the measured variables

and where b_H, b_B, b_F and b_T are weights assigned to the various influences and b_o is a constant.

The basic equation was built by adding one group of variables at a time, with the groups being added to the equation in the order listed above. The measure reported as an estimate of the importance of each group of variables was the addition to the proportion of variance in achievement scores explained (addition to R^2) when that group was added to the relationship. This would have created no problem if the variables had been

independent. But since the groups of explanatory variables were highly intercorrelated, as the background characteristics of students are with the characteristics of the schools they attend, the addition to the proportion of variance in achievement that each explained was dependent on the order in which the variables were entered into the regression equation. If two variables are correlated they share a certain amount of explanatory power. The shared portion of variance in achievement which can be accounted for by either variable will always be attributed to that variable which is entered into the regression first. Accordingly, the explanatory value of the first variable will be overstated and that of the second variable understated.

The data from the Equality of Educational Opportunity study have been reanalyzed many times. However, most of the analysts (Smith, 1972; Coleman, 1972; Mayeske, 1972, 1973a) could find few grounds for disagreement with the report finding "that schools bring little influence to bear on a child's achievement that is independent of his background and general social context" (Coleman et al., 1966:325).

There have also been a number of studies of the effects of school on learning based on other large data sets, such as the Jencks and Brown (1975) analysis of the Project TALENT data and the International Association for the Evaluation of Educational Achievement (IEA) studies (Purves, 1973; Thorndike, 1973; Comber and Keeves, 1973). However, until a later investigation of the problem by Coleman (1975) himself, the general findings still indicated that school had relatively little impact on differences in achievement.

In "Methods and Results in the IEA Studies of Effects of School on Learning," Coleman (1975) reanalyzed the data from the IEA studies for literature, reading, and science to demonstrate what he considered more appropriate analytic procedures for determining the relative effects of school on learning using cross-sectional data. He proposed combining each cluster of variables into a signle composite variable and then using the standardized regression coefficients of the composite variables to estimate the overall effect of each cluster. The analytic procedure was basically a path analysis using the three derived variables of home, type of school and program, and school resources. When he applied this

technique to the IEA data, he found a higher relative effect of school resource variables, compared to home background variables, than had been previously reported. He also found that the relative influence of home background in determining achievement compared to the relative influence of school in determining achievement different for specific subject matters. Reading achievement was more of an outgrowth of home influences than achievement in the other two subjects measured--literature and science. This led to another conclusion--that studies based on tests related to reading ability, such as some of the studies using the original Equality of Educational Opportunity data, will probably underestimate the general effects of the school as compared to the effects of the home.

To improve and refine our understanding of the educational process, we need good estimates of the relative effects on learning of clusters of variables as well as the relative effects of variables within clusters. What is needed most to answer questions about the effect of school on learning is a large-scale controlled social investigation. However, until such a large-scale longitudinal experiment becomes ethically, politically and financially possible, the best data available will continue to be that from analysis of large-scale observational or descriptive surveys.

Even though the use of multiple linear regression techniques to answer questions of effects of schooling has often led to disappointing and inconclusive results, investigation of the utility of analysis techniques that can be used with cross-sectional data should be continued and the work of Coleman (1975) seemed to offer promise. However, Coleman applied his technique to the IEA data post hoc, and was unable to complete a full investigation of his suggested technique. The present study was designed to help corroborate Coleman's findings based on the IEA studies and to investigage the utility of the total suggested procedure. It used the procedure suggested by Coleman (1975) and data collected in 1976 by the National Assessment of Educational Progress to investigate the relative importance and effect of three clusters of variables--home environment variables, community and school environment variables, and school instructional variables--on educational achievement in the areas of mathematics, political knowledge and socio-political attitudes.

The Data

Overview of the National Assessment of Educational Progress

The National Assessment of Educational Progress is a project funded by the U.S. Department of Health, Education and Welfare. The primary purpose of National Assessment is to gather information concerning the degree to which educational goals are being met nationally and to make this information available to the general public and to educational decision-makers so that problem areas can be identified, priorities established, and progress over time determined.

In an effort to determine the educational attainments of American youth, National Assessment annually collects achievement data in a variety of learning areas from nationally representative samples of nine-year-olds, thirteen-year-olds and seventeen-year-olds--the three age levels that generally mark the end of primary, intermediate and secondary education. Different subject areas are assessed every year, and subjects are periodically reassessed to measure changes in achievement over time. National Assessment has interviewed and tested more than 750,000 persons since 1969 with approximately 70,000 to 100,000 persons participating each year.

Each subject area assessment evolves from a consensus process, with the final product being the result of several years' work by a great many educators, scholars and lay persons from all over the nation. Initially, these people design objectives for each subject area, identifying general goals they feel Americans should accomplish in the course of their education. The broad educational objectives used by National Assessment represent the combined opinion of a diverse group of people about what young people should know and be able to do.

After careful reviews, these objectives are given to item writers, who create both multiple-choice and open-ended measures appropriate to the objectives. Numerous people from across the country are also involved in the development of the items for these assessments. Panels of specialists and lay persons review and revise the items before and after the various phases of field tryouts. To help guard against the possibility of racial, ethnic or sexual bias, many of the reviewers represent minority groups.

When the exercises have passed all the reviews, they are administered to national probability samples of the target age groups. Respondents are

selected in accordance with a carefully constructed, deeply stratified, multi-stage probability sample design. The procedure guarantees that each respondent is selected with a known probability. By weighting each respondent's performance inversely to his or her probability of selection, appropriate generalizations can be made to the entire population of nine-year-olds, thirteen-year-olds or seventeen-year-olds.

National Assessment maintains uniform administration procedures by tape recording instructions and items and by using trained administrators, rather than classroom personnel, to conduct assessments. The field staff is hired on a permanent basis and trained each year specifically for each subject area assessment. It should be emphasized that National Assessment sampling procedures, as well as administration procedures, such as allowing more than adequate response times on the paced tapes, were developed to assure low non-response rates both for overall sample coverage and for specific items.

Results to multiple-choice exercises are scored by optical scanning machines. Open-ended responses are categorized according to carefully developed scoring guides by trained readers who have experience in the subject area. Again, each scoring guide represents a consensus of opinion about which responses are acceptable in terms of the objective being measured.

Considering the face validity of the objectives and achievement measures, the quality of the sample design, the use of trained field personnel and the care taken to assess each subject area--it takes five to six years to develop, administer, score and analyze each assessment--the National Assessment data base is appropriate for a number of secondary analyses.

Finally, although National Assessment does not use a longitudinal design, it is an ongoing endeavor. Some of the background variables investigated in this study have already been incorporated into three successive assessments. As those data are collected from the field and prepared for analysis, there will be opportunities to replicate parts of this study with data related to different learning areas.

The Sample

Data collection by NAEP in the spring of 1976 was particularly extensive in terms of both learning areas assessed and background variables. Over 34,000 seventeen-year-olds attending school were assessed in three subjects (citizenship, social studies and selected mathematics) and a substantial amount of new background information was collected. Respondents answered background questions specific to each learning area, as well as a number of questions adopted from the Student Questionnaire developed for use by the National Longitudinal Study of the High School Class of 1972 (NLS). The background questions, numbering over 150, provide information on traditional home, community and school variables in addition to personal habits such as time spent watching TV and doing homework.

The target population consisted of seventeen-year-olds (specifically students born between October 1958 and September 1959) enrolled in public or private school. Age-eligible persons who were non-English speaking, institutionalized or handicapped in such a way that they could not respond to the exercises as administered were excluded from the sample.

A deeply stratified, multi-stage design with oversampling of low-income and rural areas was used (Benrud et al., 1977). The multi-stage design involved sampling in successive steps or stages to ensure representation of specific subpopulations and a designed level of precision.

The first stage was the selection of primary sampling units (PSUs), which consisted of counties or groups of contiguous counties meeting a minimum size requirement. The PSUs were stratified by region, and within region by size of community categoires. The regions and size of community categories used for stratification are shown in Table 1. From the stratified list of 1,101 PSUs, a probability sample of 75 PSUs was drawn.

The second stage of the sampling was the selection of schools. All public and private schools in each selected PSU were listed and a probability sample of schools was then drawn for each sample PSU. Assessment was conducted in a total of 411 schools.

The third stage was the selection of students. Every eligible student in each selected school was listed; a random sample of students was then drawn and randomly assigned one of the assessment packages scheduled for that school.

TABLE 1

NATIONAL ASSESSMENT SAMPLING STRATA

Classification	Strata
Region	Northeast Southeast Central West
Size of Community	The thirteen largest Standard Metropolitan Statistical Areas (SMSAs) based on fourteen-year-old populations in the 1970 Census.
	The remaining 57 SMSAs with total populations in excess of 500,000.
	The 162 remaining SMSAs.
	Non-SMSA counties with 65 percent or less of their fourteen-year-old population classified as rural in the 1970 Census.
	Non-SMSA counties with more than 65 percent of their fourteen-year-old population classified as rural in the 1970 Census.

At every stage, sampling units were selected with known probabilities. Thus, an unbiased weight for each respondent can be computed as the inverse of that respondent's probability of selection. Use of these weights is, of course, necessary to avoid distortion in population estimates due to the differing probabilities of selection.

A total of 32,484 respondents were assessed. However, not all respondents took all exercises. Exercises were grouped into booklets and each respondent completed only one booklet. Approximately 2,500 seventeen-year-olds attending school responded to each booklet. Due to the sample design, the students taking each booklet constituted a separate probability sample of the target population of in-school seventeen-year-olds.

National Assessment's policy is to take only one class period of a student's time and to avoid heavy demands on school personnel. Thus, each booklet takes no more than fifty minutes to administer, and there are

limits on the number of booklets that can be administered and students that can be assessed in any one school.

Two booklets of mathematics items were administered, each to twice the usual number of respondents; and nine booklets containing items related to political knowledge and socio-political attitudes were administered. The sample sizes for each booklet are shown in Table 2.

TABLE 2

SAMPLE SIZES

Subject	Booklet Number	Sample Size
Mathematics	1A, 1B	4,984
	2A, 2B	5,030
Political Knowledge and Socio-Political Attitudes	3	2,465
	4	2,461
	5	2,616
	6	2,490
	7	2,506
	8	2,430
	9	2,467
	10	2,533
	11	2,502
Total respondents for mathematics:		10,014
Total respondents for political knowledge and socio-political attitudes:		22,470

Bias due to non-response is a problem with virtually every sample survey. However, National Assessment took several steps to assure that the planned national sample size would be achieved. First, due to school absenteeism a larger random sample was selected for each administration than was really neeeded. This larger sample size took into account information from prior assessments about response rates in various types of school. Secondly, a follow-up effort to assess "no-shows" was conducted. This follow-up increased the average sample coverage from 75 percent to 85 percent.

The Dependent Variables

To strengthen its analysis and reporting procedures, National Assessment has subject matter specialists cluster items into groups that relate to specific content domains. The majority of the items included in the 1976 assessment were judged to measure achievement in political knowledge, "values" or socio-political attitudes, and some fundamental operations in mathematics. These are the three subjects used as dependent variables in this study.

The majority of the political knowledge items were concerned with five content areas. One group of items dealt with recognition of constitutional rights and understanding of the law. A second cluster of items, which asked questions about the structure and function of government, covered such concepts as separation of powers and the functions of the various levels of government. The other three major topics concerned understanding the electoral process, recognition of government officials, and some knowledge of international affairs.

Questions about political attitudes were concerned with valuing constitutional rights, respect for the opinions of others and willingness to participate in the political process. The social attitudes items measured belief in equal treatment for everyone, regardless of their sex, race, or religious beliefs, willingness to help others in need, and consideration of the consequences of one's own actions.

The mathematics items represented a specially modified supplement to the 1972-73 full-scale mathematics assessment. The items were selected to determine whether seventeen-year-olds could successfully cope with a number of basic computational operations. Approximately half the items dealt with addition, subtraction, multiplication and division of integers, decimals, and fractions as well as properties of numbers and operations on them, such as rounding and ordering. The remainder of the items concerned problem solving, basic probability and statistics, reading scales and charts, measurement, geometry, and elementary algebra.

Approximately half the items used to construct the dependent variables have not been released to the public but are being kept secure by National Assessment for use in future reassessments to measure change in achievement

over time. The released items are fully documented in existing National Assessment publications (National Assessment 1977a, 1977b).[2]

The Independent Variables

The data on explanatory variables were obtained from four sources: questionnaires answered by students, questionnaires answered by the principal of each school, basic student level information provided by item administrators and U.S. Bureau of the Census information. Each of the National Assessment questionnaires is listed and summarized below.

1. Standard NAEP student background questions, contained in each booklet of items--presence of newspaper, magazines, 25 books, and encyclopedia in home; level of each parent's education; state student lived in at age nine and at age thirteen.

2. Supplementary Student Questionnaire, adapted from questions used by the National Longitudinal Study administered in conjunction with each booklet of items--type of high school program; grades in school so far; time spent on homework per week; number of schools attended since first grade; length of time lived in present community; hours of television watched previous night; frequency with which English or other language is spoken in home; number of older and younger siblings; self-identification of race; level of schooling desired by parents for respondent, level of schooling desired by respondent, level of schooling expected by respondent; presence in the home of a specific place to study, daily newspaper, dictionary, encyclopedia, magazines, record player, tape recorder, color television, typewriter, electric dishwasher and two cars that run; teachers' influence on level of educational plans after high school; use by teachers of lectures, student-centered discussions, student projects, essay writing, field trips, individualized instruction, teaching machines, television lectures, studying from textbooks, and the library as instructional

[2]National Assessment has published several selected reports which provide descriptions of the performance data for items used in the dependent variables. These reports are: Education for Citizenship, Report 07-CS-01; Changes in Political Knowledge and Attitudes, 1969-76, Report 07-CS-04; Citizenship, An Overview, 1975-76, Report 07-CS-06; and Selected Supplemental Mathematics Exercises.

techniques in courses taken this year; participation in extra-curricular activities; self-concept; students' attitude toward their school; what is important to the respondent in their life; and persons who have influenced respondents' future life.

3. Information collected by the administrator as part of each booklet--grade level, sex, birth month and race of respondent.

4. Standard NAEP School Principal's Questionnaire--percentage of students in eight size of community categories, percentage of students' parents in six occupation categories, school eligibility for ESEA Title I aid and percent of students so eligible, and percent of students white.

5. Supplementary Basic Mathematics Principal's Questionnaire--use of standard mathematics textbooks, computer assisted instruction and individualized materials; presence of mathematics laboratory, manipulative materials, hand-held calculators and computer terminals for each of the four high school grade levels.

6. Student background questions for mathematics contained in each mathematics booklet--students' attitudes toward mathematics classes; whether they have taken general mathematics, business mathematics, first-year algebra, second-year algebra, geometry, trigonometry, statistics and calculus courses; whether they have used a calculator; and students' habits in mathematics classes of finishing assignments, checking answers, and finding out the right answers to problems.

7. Student background questions for political knowledge and socio-political attitudes contained in each citizenship/social studies booklet--frequently of class discussions about national and international politics, number of high school courses dealing with government or politics, to what extent they have studied how to acquire information and how to analyze values and alternatives; student attitudes toward history or government courses and opportunities for student input and decision making in school.

8. Census information applied as part of the sample design--region and size of community.

The Analysis

A Model for the Analysis

The major controversy about previous effects of school on learning studies has tended to center on the methodology used in the regression analyses. There seems to be general agreement about the theory underlying these studies since all the studies referenced suggest some kind of scheme in which home background precedes, in a causal sequence, various levels of school variables. There also seems to be general agreement that comparisons should be made between the effects of basic clusters of variables, as well as between the variables within specific clusters, the eventual goal being identification of the relative effects of specific variables so that decisions can be made concerning the efficacy of particular school practices.

The methodology Coleman presented in "Methods and Results in the IEA Studies of Effects of School on Learning" (1975:374-80) was implemented using the IEA model for analysis; for purposes of comparison, this study also used the IEA model, as refined by Coleman. The basic proposition underlying the model is that earlier events influence later events. The home influences the type of school and community; home and the type of school influence the methods of instruction, and all three influence achievement.

Consider the following diagram indicating the model for the analysis.

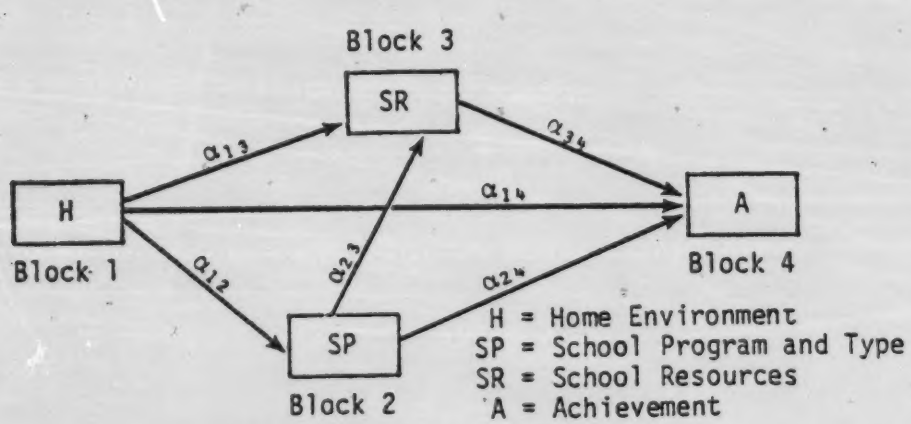

Figure 1. Analytic Model

The dependent variable is achievement and the independent variables are grouped into the blocks of home background variables, school type and program variables, and school resource and instructional variables. Blocks are used not only to group variables into sets that are similar in type and interpretation, but also to reflect their causal relationships and thus define their sequential order of introduction into the regression analysis.

Each student was considered as coming to his present school from a home which had influenced his learning through heredity and environment, as well as through the type and quality of school he had attended. The first block of variables entered into the equation, therefore, were those variables associated with the socioeconomic characteristics and the educational and cultural level of the student's home.

The next set of factors taken up included the neighborhood of the school, the nature of the school, and the type of course or program the student had followed in school. These variables consistuted block 2.

After allowance had been made for the home background and the nature of the school and program in which the student was currently enrolled, variables concerning the courses and instructional practices of the school were entered into the regression. This third block of variables included school facilities, students' exposure to the subject, and instructional practices used in the school. In the following discussion, the terms "block 1" and "home background" are used interchangeably for the first group of variables. Similarly, "block 2" and "type of school and community" or "type of school program" are synonymous, as are "block 3" and "school" or "school curricular and instructional variables."

Computation of the Dependent Variables

To report the results of achievement in each subject, National Assessment determines whether each student responded acceptably to each item and reports population estimates of the percentages of acceptable responses. The procedure for this study was to use the standard acceptable or not acceptable response determination to compute achievement measures for individual students. As an initial achievement measure, a percentage correct was computed for each student as the number of items answered acceptably divided by the number of items attempted. Since every multiple-

choice exercise included "I don't know" as a choice, and "I don't know" was accepted as a response to open-ended exercises, no corrections for guessing were deemed necessary. Table 3 shows, for each booklet of exercises, the number of items included in each achievement area, the average non-response rate for those items, and the reliability coefficient, using Kuder-Richardson Formula 20, for the percentage correct achievement measure based on those items. As can be seen, the reliability of the total scores is quite high for mathematics, fair for political knowledge, and lower for socio-political attitudes. The non-response rates were quite low in every case.

The percentage acceptable scores for each student were comparable among students who took the same exercise booklet, but not among students who took different booklets, since the distribution of item difficulties varied from booklet to booklet. Appendix A shows the first four moments of the distribution of the percentage acceptable scores for each booklet. In addition, the accuracy with which these measures estimate a student's achievement level varied from booklet to booklet, since each contained a different number of items.

To make the achievement measures comparable among exercise booklets, the percentage acceptable measures were converted to percentile ranks within each booklet. Since the respondents to each set of identical booklets represent separate national probability samples, a percentile score based on any one of the sets of booklets is an estimate of that student's percentile rank within the national population, and thus the percentile scores are in fact comparable among students who responded to different bookelts. The varying degrees of accuracy of the achievement measures were reflected by weighting each respondent by the number of items to which he responded. This weighting was in addition to (i.e., multiplied by) the weight already assigned by National Assessment to each respondent on the basis of the sample design. This had the effect of giving equal weight to each exercise.[3]

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[3]Due to the very low non-response rates, the weighting by number of items attempted had a negligible effect on the relative weights of respondents within any one booklet.

TABLE 3

SUMMARY OF ITEMS USED IN DEPENDENT VARIABLES

Booklet Number	Number of Items in Booklet	Average Percentage of Non-Response	KR-20 Reliability Coefficient
Mathematics			
1A, 1B	43	0.15%	.93
2A, 2B	40	0.30%	.88
Total	83	Average 0.22%	Average .91
		Wtd. Avg.* 0.22%	Wtd. Avg.* .91
Political Knowledge			
3	14	0.14%	.69
4	11	0.75%	.52
5	13	0.12%	.70
6	14	0.29%	.67
7	26	0.07%	.77
8	16	0.08%	.69
9	34	0.06%	.79
10	14	0.16%	.71
11	9	0.16%	.60
Total	151	Average 0.20%	Average .68
		Wtd. Avg.* 0.16%	Wtd. Avg.* .71
Socio-Political Attitudes			
3	4	0.32%	.42
4	8	0.67%	.48
5	4	0.65%	.35
6	9	0.23%	.60
7	22	0.06%	.73
8	10	0.36%	.59
9	15	0.27%	.62
10	31	0.08%	.78
11	7	0.36%	.36
Total	110	Average 0.33%	Average .55
		Wtd. Avg.* 0.23%	Wtd. Avg.* .64

*Weighted averages are weighted by number of items in booklet.

While the use of percentile ranks rather than raw percentages yields comparability among booklets, it creates the problem that percentile ranks are, by definition, uniformly distributed. Intuitively, one would expect

that equal differences in percentile scores would reflect greater differences in achievement when the difference is between percentiles at either end of the scale than when the difference is between percentiles near the middle of the scale. While there are not purely objective grounds on which to speculate about the exact shape of the distribution of "achievement," most would agree that it is not uniform and that a symmetric, "variance-increasing," transformation to magnify differences at either end of the scale is needed (Magnuson, 1966:240).

The logit transformation,

$$\text{logit}(x) = \log(x) - \log(1-x) = \log(x/(1-x))$$

was chosen. It has the desired properties of symmetry and stretching the tails of the percentile distribution. In addition, it is widely known and used, easy to compute, and considered generally appropriate for transformation of percentile and percentage data (Tukey, 1977:623; Mosteller and Tukey, 1977:109).

Because the number of respondents to each booklet was very much larger than the number of items in each booklet, a large number of respondents were tied in terms of either the percentage acceptable or the percentile rank achievement measures. Due to this discreteness in the achievement measure, the distribution of the percentile scores was not truly uniform, but somewhat "lumpy." An additional adjustment was made to remove some of the effects of this discreteness from the logit values.

When the logit transformation is applied to uniformly distributed data, the resulting values follow a distribution known as the logistic. This distribution has a mean of zero and the central 95 percent of the probability is between -3.66 and 3.66. The standard deviation of the transformed achievement measures was approximately 1.80; but due to the discreteness of the data this is slightly less than the value for a true logistic distribution. Appendix A shows, for each booklet of items, the first four moments of the actual distributions of the percentile scores, the uncorrecred logits of the percentile scores, and the modified logits that were actually used.

Modified logit values were computed separately for each booklet of items within each content area. Thereafter, all respondents were treated

as a single sample, weighted as described earlier, and the modified logits of the percentile ranks were their achievement measures.

Computation of the Independent Variables

One of the first major tasks in the analysis was to reduce the possible explanatory variables to a manageable number. The techniques for reduction included:

1. rejecting variables based on questions with high non-response rates;

2. rejecting variables that seemed to be as much, or more, results of achievement, as contributors to achievement;[4]

3. rejecting variables which were only weakly related to the dependent variable, whether due to poor distributions or simple failure to discriminate;

4. selecting the most promising of near duplicate variables; and

5. compounding similar variables which were found to have significant relationships with the criterion.

The process of deciding which variables would be useful predictors and whether they should be used singly or in combination was a lengthy process involving much trial and error. Distributions were obtained for response categories of independent variables for each subject area. For each response category of each independent variable, the distributions of the achievement levels for respondents in that category, and the number and percentage of respondents in that category were computed. One-way analyses of variance were conducted on the dependent variables for categorical independent variables and zero-order correlations were obtained for interval independent variables. On the basis of this information a number of variables were found to have little or no relationship with achievement. Variables that fail to discriminate well on the basis of one-way analyses of variance or zero-order correlations occasionally become significant predictors in the presence of other variables. However,

[4]Coleman, in his reanalysis of the IEA data, did not treat variables related to student attitudes toward school as affecting achievement (Coleman, 1975:356). Since others (Smith, 1972:317) have also questioned the appropriateness of such variables for effects on learning studies, they were considered concomitants of achievement and not included in this study.

considering the number of variables, the need to reduce the data simply to make the analysis practical, and an intuitive agreement with most findings, such variables were not retained.

The initial analyses not only indicated variables that did not predict achievement, but also served as the basis for the next data reduction step of selecting one variable from among sets of duplicate variables. In cases where assessment data provided duplicate measures of variables, such duplicated variables almost always showed similar explanatory power and the decision was usually to select the variable with fewer categories.

The final data reduction step was to compound similar variables. Basically, this analysis consisted of grouping variables, primarily on the grounds of their conceptual similarity, into clusters and graphing mean levels of achievement for the categories of each of the variables. If the plots and correlations of conceptually similar variables indicated that the variables were also similar in terms of their relationship to achievement, then an effort was made to combine them.

Choices among variables were made primarily on the basis of their explanatory power, both alone and in combination with other variables. For example, it was sometimes clear, based on the relationship of the combined variable to the criterion as opposed to the relationship of the component single variables to the criterion, that much explanatory power had been lost by combining variables. In other cases, variables were kept in two or more alternate forms until final choices between them could be made on the basis of the regression analyses of the dependent variables. Graphs of mean levels of achievement for the various categories of single or combined ordinal variables were used to determine whether the variables seemed to have a linear relationship to achievement and thus could be reasonably used as interval variables in the regression analyses.

Assigning the Variables to Blocks

The following procedures were used to determine which variables would comprise the three blocks. First, the reports from the original IEA studies of science (Comber and Keeves, 1973), literature (Purves, 1973) and reading (Thorndike, 1973) were read to determine which variables were included in the different blocks in the IEA analyses. If a variable was used in the IEA studies and it was available from the National Assessment

data, it was automatically placed in the same block as in the IEA studies.

This left a number of variables unclassified, even after the initial data reduction procedures. National Assessment data provided all the IEA block 1 and 2 variables plus some additional variables. For block 3, correspondence bewteen National Assessment variables and IEA variables was not as direct as it was for the first two blocks.

Some unclassified variables were placed into blocks on the grounds that the description of the blocks from the IEA report together with National Assessment documentation, clearly indicated a particular block as the logical chocie. Others were categorized on the basis of a judgmental survey distributed to members of the National Assessment professional staff. The results of the research of the IEA studies and the survey were three sets of variables, one set for each block, to be used for the initial regressions. The variables considered as block 1--home background--variables are listed in Table 4, those as block 2--type of school and community--variables in Table 5, and those as block 3--school resource and instructional--variables in Table 6.

The Regression Analysis

As mentioned in the introduction, there has been difficulty in obtaining general agreement as to which measures are appropriate to use to study questions about the effects of school on learning. Coleman's point in his review of the IEA studies (1975) is that even subtle differences in the questions of interest necessitate the use of different measures and sometimes authors of effects of school on learning reports have not always carefully and explicitly related their methodology to their conclusions.

Coleman (1975) emphasizes that different measures should be used to answer the questions about relative effects of school variables on learning as compared to other clusters of variables than should be used to answer the questions about the relative effects of specific variables within clusters. He also states that if the problem, as in this study, is to establish the relative effects of school variables on learning as compared to other clusters of variables, then different measures than those normally reported should be used.

TABLE 4

BLOCK 1 (HOME BACKGROUND) VARIABLES
AFTER INITIAL SELECTION AND REDUCTION

Lower level of education of either parent
- Both unknown
- Not graduated from high school
- Graduated high school
- Post high school

Reading materials in home index

Family size

Birth order

Only child

Age in months

Sex (dummy for female)

Race
- Black
- Hispanic
- White
- Other

Language spoken in the home
- Mainly English
- Strong bilingual
- Non-English

Hours television watched last night

Specific place for study in the home

Typewriter in the home

Electric dishwasher in the home

Record player in the home

Tape recorder or cassette player in the home

Color television in the home

Two or more cars or trucks that run

TABLE 5

BLOCK 2 (TYPE OF SCHOOL AND COMMUNITY) VARIABLES
AFTER INITIAL SELECTION AND REDUCTION

Present high school program of student
- Academic
- General
- Industrial
- Occupational

Large city percent (metropolitan areas of cities with populations greater than 200,000)

Medium city percent (cities and towns with populations between 10,000 and 200,000, and suburbs of cities between 25,000 and 200,000)

Small place percent (rural areas and towns with populations of less than 10,000, unless included as a suburb in indices above)

Inner city versus suburban index (from size of community data)

Rural versus urban index (from occupation data)

SES of parents index (from occupation data)

Region of the country
- Southeast
- Northeast
- Central
- West

Percentage of students in school that are white

Whether school qualifies for ESEA Title I assistance

Percentage of students in school that qualify for ESEA Title I assistance (zero if school does not qualify)

TABLE 6

BLOCK 3 (SCHOOL RESOURCE AND INSTRUCTIONAL) VARIABLES
AFTER INITIAL SELECTION AND REDUCTION

Mathematics, Political Knowledge and Socio-Political Attitudes

- Grade level
  - Grade 10 or lower
  - Grade 11
  - Grade 12
- No homework assigned
- Average hours homework per week
- Traditional teaching methods
- Progressive teaching methods

Mathematics

- Number of basic courses
- Number of advanced courses
- Used a calculator
- Studied sets
- Studied functions
- Studied the metric system

Political Knowledge and Socio-Political Attitudes

- Number of courses in government or history
  - None
  - One or two
  - Three or more
- Studied how to analyze alternatives
- Studied how to acquire information
- Frequency of class discussion about politics
- School climate index

The IEA studies used essentially the traditional regression procedure described in the introduction. Three clusters of variables--student background variables, type of program and school variables and then school resource and instructional variables--were entered in sequence into the regression analyses. Additional variance explained when the school resource variables were entered was described as the incremental effect that school had on learning. As noted previously, the problem with this procedure is the correlation of the independent variables. Even though those students with better home backgrounds may often attend schools with better resources, this does not necessarily mean that it is appropriate to control on home background, and in doing so entirely subtract out the effects of school that are related to home background, and then label only the remaining effects as attributable to the schools.

Coleman (1975) argues that there is not necessarily anything wrong with such asymmetry, only that it is important to realize its implications so that inferences drawn are not incorrect. He feels, and this researcher agrees, that it was not appropriate to use these techniques to compare the amount of variance in block 1 and block 3 and conclude that one accounts for more variance than the other. The following discussion based on Figure 1, Analytic Model, page 13, will demonstrate why this is so.

R^2 will denote the proportion of variance in the dependent variable explained in a regression containing the blocks of variables shown as subscripts to R^2. The symbol α will indicate a standardized regression coefficient for a path along which an effect occurs. For example, α_{14} indicates the standardized regression coefficient for block 4 regressed on block 1. Loosely, α_{14} may also be used simply to denote the causal path itself from block 1 to block 4.

The IEA measure for block 1 (R_1^2) included all the variance due to the direct path and all indirect paths -α_{14}, $\alpha_{12}\alpha_{24}$, $\alpha_{13}\alpha_{34}$ and $\alpha_{12}\alpha_{23}\alpha_{34}$. The measure for block 3 ($R_{123}^2 - R_{12}^2$) not only was limited to the variance from the one direct path, but excluded that part of the direct path due to indirect paths from earlier steps. Thus the IEA block 3 measure accounted for path α_{34} less paths $\alpha_{13}\alpha_{34}$ and $\alpha_{23}\alpha_{34}$. Consequently, the variance estimate reported for block 1 was quite liberal, being based on the total variance due to block 1 variables. The estimate for block 3 was

comparatively depressed, being based only on the variance uniquely due to block 3 variables. The estimate for block 2 was somewhere in between, including all of the variance that could be accounted for by either block 2 or block 3 but not block 1, and none of the variance that could be accounted for by either block 1 or block 2.

Coleman starts with the same basic premise as most analysts: that since student populations differ at the outset, it is not possible to judge the quality of schools solely by the achievements of students leaving them. He agrees that it is necessary to control in some way for the variations in student input with which the teachers and staff of the school are confronted and that in some way it is the increment in achievement that the school provides which should be the measure of the school's quality. Coleman does not believe that variance added measures used by themselves are the best measures. He believes that for purposes of comparison symmetric measures should also be used and suggests obtaining both the unique contributions to variance by each of the clusters and the relative effects of each of the clusters as estimated by standardized regression coefficients. The major difference between these two measures is that they "control" on the other variables in different senses. When two independent variables are correlated, then the variance that may be explained by either contributes to the regression coefficients of both. In using the variance uniquely explainable by a variable, however, the variance explainable by either is not allocated to either variable. Thus, the standardized regression coefficients give a symmetric estimate of the effect of each variable, and the unique contributions to the variance give a measure which is also symmetric, but quite conservative. The idea is to use several kinds of measures to form an overall picture of the relative effects of the inputs to learning.

The essence of Coleman's recommended procedure lies in basing the interpretation primarily on the standardized regression coefficients of the blocks, much as would be done in a path analysis. The standardized regression coefficients for each block are those of composite variables computed for each block. Each composite is formed by combining all the variables in a block with weights which are their unstandardized coefficients in a regression. If, in the same regression, those variables are replaced by

their composite, the introduction of the composite does not change the weights of any other variables in the regression or the total variance explained by the regression. Thus, the composite is truly equivalent to the variables and its standardized regression coefficient properly reflects the combined effects of the individual variables.

A description of the regression methodology used in this study follows. First, for each subject matter, the linear combination of block 1, home background, variables which minimized the sum of squared deviations of the fitted values from the actual dependent variable was found. Although the same group of variables, those listed in Table 4, was used for the first regression in each subject area, different variables yielded the best fit for the different subjects.

Next the set of block 2 variables, community, school type and program (Table 5) was entered into the regression in the presence of the successful block 1 variables to find the linear combination of block 2 variables with the highest partial correlation with achievement. Again the same block 2 variables were considered for each subject, but different subject matters produced different results. Finally, the procedure was repeated for block 3 or school related variables. Due to the variables available and their logical relationship to subject matters, some of the variables used were specific to mathematics and others were specific to political knowledge and socio-political attitudes (see Table 7).

The next procedural steps involved computing the blocks of variables as composite variables and obtaining their standardized regression coefficients for the blocks as a whole. First, using the results of the regression that had produced the best fit when only block 1 variables were entered, a composite block 1 variable was computed that was the weighted sum of the variables in block 1, the weights being the unstandardized regression coefficients. The newly defined composite variable was then used as the only variable in a second regression analysis. When achievement was regressed on the composite, the standardized regression coefficient was obtained. This measure is used to describe the total effect of block 1. Next, composite variables were computed for the block 1 and block 2 variables that had produced the best fit when achievement had been regressed on block 2 variables in the presence of block 1 variables. Another

regression analysis provided the standardized partial regression coefficients $\beta_{41\cdot 2}$ and $\beta_{42\cdot 1}$. $\beta_{42\cdot 1}$ is used to describe the proportion of variation in achievement that school program or type will explain when home background variables are held fixed. Finally, using the results of the regression of achievement on blocks 1, 2 and 3, three composite variables were computed and were entered into a regression to obtain the standardized partial regression coefficients $\beta_{41\cdot 23}$, $\beta_{42\cdot 13}$, and $\beta_{43\cdot 12}$. $\beta_{41\cdot 23}$ is reported as the direct effect of the block 1 variables, apart from their effects through selecting or shaping schools, and $\beta_{43\cdot 12}$ is reported as the direct effect of block 3 variables, whether this effect implements the force of the home and school type through its distribution, or not.

Obtaining a measure of the independent effect of the school variables was more complicated since $\beta_{43\cdot 12}$ cannot merely be divided into the effects that reinforce block 1 and 2 variables and the effects that are independent of these variables. To subdivide regression coefficient $\beta_{43\cdot 12}$, it is necessary to take into account that a portion of the variance of the block 3 composite variable does not occur independently of variation in blocks 1 and 2, but rather is caused by blocks 1 and 2. However, if $R_{3(12)}$ is the multiple correlation of blocks 1 and 2 with 3, then the proportion of the variance in block 3 not associated with blocks 1 and 2 is $1-R_{3(12)}^2$ and the fraction of block 3 that is independent of blocks 1 and 2 is $\sqrt{1-R_{3(12)}^2}$. Thus, if we multiply $\beta_{43\cdot 12}$ by $\sqrt{1-R_{3(12)}^2}$ we obtain the portion of the school effect that operates totally independently of even the indirect effects of the home and type of school blocks. The measure for the independent effect of school resources on achievement is the total effect discounted by the variation of school resources that is explained by blocks 1 and 2, or $\beta_{43\cdot 12}\sqrt{1-R_{3(12)}^2}$. This is approximately equal to the square root of the "variance added" measure, $\sqrt{R_{123}^2 - R_{12}^2}$, reported as the school resource effect in the IEA studies. However, $\beta_{43\cdot 12}$ itself is the estimate of the effect school could have if all homes and communities were equal.

RESULTS

Effects of School on Learning Results

The major results of this study are shown in Table 7. The direct effect of school on achievement, expressed as a standardized regression coefficient, was .48 for mathematics, .31 for political knowledge, and .31 for socio-political attitudes (Measure 1 in Table 7). These coefficients represent the direct effect of the school variables if they were distributed independently of home background. The direct effect of home on achievement, apart from its effect through the other blocks, was .29 for mathematics, .27 for political knowledge and .22 for socio-political attitudes (Measure 2 in Table 7). The direct effect of home was substantially less than the direct effect of school in each instance.

The ratios of the direct effect of school to the direct effect of home background showed that school had the largest relative effect in the area of mathematics, the next largest in the area of socio-political attitudes, and the least in the area of political knowledge (Measure 3 in Table 7).

However, because the home acts to determine the school resources themselves, the direct impact of the home on achievement does not express the total effect of home. Consequently, it is appropriate to compare the direct effect of the home apart from its effect through school with the effect of school that is independent of, or over and above, even the indirect force of home background and school type. It is also useful to compare the total effect of home background with the direct effect of school (whether this effect is implementing the effect of home background or independent of it).

When the direct effect of school was adjusted to remove the portion of that effect representing the indirect effects of the prior blocks, the independent effect of school was found to be only slightly less than the direct effect. The ratio of the independent effect to the direct effect was about .93 in each subject (Measure 4 in Table 7). Thus, the direct effect of variations in home background on achievement was still far less than the totally independent effect of variations in school on achievement. This means that changes in school curriculum and instruction should have

TABLE 7

OVERALL RESULTS FOR ALL SUBJECT AREAS

Measure	N=10,014 Mathematics	N=22,470 Political Knowledge	N=22,470 Socio-Political Attitudes
1) Direct Effect of School ($\beta_{43.12}$)	0.482	0.313	0.307
2) Direct Effect of Home Background ($\beta_{41.23}$)	0.293	0.269	0.221
3) Ratio of Direct Effect of School to Direct Effect of Home Background ($\beta_{43.12}/\beta_{41.23}$)	1.645	1.164	1.389
4) Ratio of Effect of School Independent of Home Background and Type of School to Direct Effect of School $\left(\sqrt{1-R_{3(12)}^2}\right)$	0.923	0.936	0.926
5) Effect of School Independent of Home Background and Type of School $\left(\beta_{43.12}\sqrt{1-R_{3(12)}^2}\right)$	0.445	0.293	0.284
6) Total Effect of Home Background (β_{41})	0.523	0.418	0.358
7) Ratio of Direct Effect of School to Total Effect of Home Background ($\beta_{43.12}/\beta_{41}$)	0.922	0.749	0.858
8) Ratio of Direct Effect of Home Background to Total Effect of Home Background ($\beta_{41.23}/\beta_{41}$)	0.560	0.644	0.617
9) Total Direct Effect of Type of School ($\beta_{42.1}$)	0.331	0.247	0.191
10) Effect of Type of School Independent of Home Background $\left(\beta_{42.1}\sqrt{1-R_{12}^2}\right)$	0.308	0.234	0.183
11) Ratio of Total Direct Effect of Type of School to Total Effect of Home Background ($\beta_{42.1}/\beta_{41}$)	0.633	0.472	0.534

a greater net effect on achievement levels than changes in home background, assuming that the two could be changed separately.

Of course, as things stand, the home background and the school are related. The total effect of variations in home background, including both its direct effect and its indirect effect through its influence on the other two blocks, was .52 for mathematics, .42 for political knowledge, and .36 for socio-political attitudes (Measure 6 in Table 7). In all three areas, the total effect of home background was larger than the direct effect of the school variables. When all the effects of home on achievement, including those that operate indirectly through the type of school and school instructional variables, are considered, variations in the home did appear to have a greater overall impact on learning than variations in the school.

Even so, the comparison of the direct effect of the school variables to the total effect of the home background variables showed that the direct effect of the school variables was .92 as large as the total effect of home for mathematics, .75 as large as the effect of home for political knowledge, and .86 as large as the effect of the home for socio-political attitudes (Measure 7 in Table 7). Even though the total home background effect was never less than the school effect, these comparisons showed a high relative effect of school variables as compared to home background, far higher than could be used to support any conclusion that school makes little or no difference.

For mathematics, the direct effect of school was almost equal to the total effect of home background. The next largest relative effect of school was found for socio-political attitudes. Of the three areas included in this study, the relative effect of school was smallest for the area of political knowledge--only .75 as large as the effect for home background. However, this is about equal to the largest of Coleman's (1975:379-80) ratios of this type presented for the United States--.70 for fourteen-year-olds in the area of literature and .76 for ten-year-olds in the area of science.[5]

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[4]Coleman's results for the IEA studies are reproduced in full in Appendix B.

Only half to two-thirds of the total effect of home on achievement was expressed directly (Measure 8 in Table 7). The rest was expressed indirectly through its effect on the type of school and the school instructional variables. However, it is also interesting to note that variations in society that act through the schools, but independent of the home, accounted for most of the variation in types of school or school instruction. The independent effect of type of school, like the independent effect of school, was almost as large as its direct effect (Measures 9 and 10 in Table 7). Although the total effect of variations in home background on achievement was substantial, home appeared to exert less influence on variations in achievement through the type of school and school resources than did other variations in society that act through the type of school and school instruction.

The effect of type of school and type of school program is the most difficult to discuss since this effect is largely a result of the selection of differently achieving students into different programs or schools. The effect of this block of variables appeared to be derived primarily from the difference between students in an academic school program and those in all other types of school program (see Appendix C.) The total effect of variations in home background on achievement (Measure 6) as well as both the direct and indirect effects of school instruction (Measures 1 and 5) were far greater than the effects of type of school program (Measures 9 and 10). Relative to home background, variations in school program appeared to have more effect on mathematics achievement than on political knowledge and socio-political attitudes (Measures 11 in Table 7). The independent effect of school program, over and above implementing the effect of the home (Measure 10), was slightly larger than the direct effect of the home for mathematics and only slightly smaller than the direct effect of the home for political knowledge and socio-political attitudes (Measure 2). However, it should be remembered that the direct home effect shown in Table 7 is the home effect in the presence of all three blocks, while the total and independent effects of type of school program were computed without the block 3, school resource, variables being present in the regression.

Summary of Effects of School on Learning

The relative effects of school on learning were quite large for all three subject matters included in this study. The effect of school on learning was substantially larger than the effect of type of school and school program and even tended to be quite high relative to the effect of home on learning. Although the largest total effect on achievement for all three subjects was due to variations in home background, the effects of school on learning were comparatively large.

The relative effects of school on learning estimated by this study were much larger than the effects reported by previous studies. The effects of school on learning were quite large, even in comparison to the total effects of home on learning--the ratios being .92 for mathematics, .75 for political knowledge and .86 for socio-political attitudes. These ratios were even higher than those reported by Coleman (1975:379-80). For the United States, at age fourteen he found the ratios of direct school effects to total home effects to be .70 for literature, .60 for reading and .60 for science. The U.S. ratios Coleman reported for age ten were .47 for reading and .76 for science.[6]

Both the results of this study and the results presented by Coleman (1975:379-80) suggested that the independent effect of school, over and above the indirect effects of home and type of school, was almost as large (a ratio of approximately .93) as the total direct effect of school. The data from this study clearly indicated that a great deal of the effect of home background was derived from its indirect influence on achievement through the type of school and schooling itself. The direct effect of home on achievement appeared to be far less than the direct effect of school on achievement, even after the direct effect of school had been adjusted to remove the indirect effects of the home and type of school and program. School influences independent of home influences had a much higher effect on learning than home influences independent of school influences.

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[6]Since Coleman does not present data for the grade twelve students, specific comparisons with the results of this study are difficult. His results for ten-year-olds and fourteen-year-olds are reproduced in full in Appendix C.

This does not mean that home background did not have a substantial effect on achievement. Considering the total impact of home on achievement, including the portion of its influence implemented through type of school and school instruction, home background variables had a greater influence on achievement than either of the other two blocks of variables. The total effects of home background were .53 for mathematics, .42 for political knowledge, and .36 for socio-political attitudes. The IEA results presented by Coleman (1975:379-80) also indicated that the total effects of home background on achievement were quite high for the United States. These effects were among the largest for the six countries reported, averaging .46 for age fourteen and .44 for age ten.

Even though home background had a large influence on achievement, so did schools. Not only would home lose one-third to one-half its total effectiveness if it did not influence school, but the effect of school aside from any effects of the home is also relatively large. Most of the effect of school is unrelated to home and has a lage impact on achievement over and above the effect of the home circumstances of the student. These results confirmed Coleman's earlier findings that an analysis which compares similarly computed effects of home and school variables would show school to be much more strongly related to achievement than had been previously reported.

Summary of Effects of Specific Variables

In the following summary, the statements about the relative strengths of the individual variables in the regressions are based primarily on the multiple regression coefficients. (Detailed numerical results for each of the regressions performed in this study, including these coefficients, are contained in Appendix C.) It must be stressed that interpretation of these coefficients requires great care. First, regression coefficients measure only association, not causality. Second, since each block contained many similar variables competing to measure the same thing, the variables were correlated and tended to be proxies for each other. This means the data are not necessarily going to reveal which variables were most important. Even if some variables really were causal, there is no way to know if their effect appeared in the regression as a coefficient on the proper variable or as a coefficient on a proxy variable. Third,

the variables included in the blocks may have acted mainly as proxies for variables not even included in the regression. Still, for whatever reasons, some of the individual variables did appear to be strongly associated with achievement in all three subjects and these results are summarized in the following discussion.

Considering all three subjects included in this study, the Lower level of education of either parent and the index of Reading materials in the home appeared to be the most relevant home background variables. Race, Language spoken in the home, and Sex also tended to be effective explanatory variables for the three subjects, but results within the various categories changed from subject to subject. For example, Hispanic was a good negative predictor for mathematics and political knowledge, but a positive predictor for socio-political attitudes. Also, as has generally been the case, the sign of the sex difference depended on the subject matter. In this study males had the advantage in mathematics and political knowledge, while females did better in the area of socio-political attitudes. Hours of television watched last night and Family size appeared to have consistent, but not remarkably negative effects on achievement in each of the three areas. The presence of a Typewriter in the home and Record player in the home tended to have weak but consistent positive relationships with achievement.

For block 2, the most relevant variable appeared to be Type of school program. Enrollment in an Academic school program, the single most effective of the type of school and community variables, was positively tied to achievement. This would be expected, since the variable is probably at least a partial proxy for academic ability. Although variables related to the average SES of the student body in the school and the racial mix of the students in the school appeared strong when only block 2 variables were considered, all were far weaker in the presence of block 1 variables.

The most effective school resource and instructional variables appeared to be those related to the students exposure to the subject matter. In all three subjects included in this study, the number of courses taken and the study of topics within the subject were powerful predictors of achievement. The traditional teaching methods index, based on teachers' use of textbooks and lectures, seemed to be effective in the two areas of

mathematics and political knowledge. The Progressive teaching methods index, based on extent of use of class discussions, class projects, essay writing and use of the library or media center, was not quite as effective a predictor of achievement, except in the attitudinal area. Homework variables also were related to achievement in all three subject areas. Whether homework was assigned appeared very important in mathematics, while the amount of time spent doing homework tended to be more closely associated with achievement in the two political areas.

REFERENCES

Armor, D. J. (1972). "School and Family Effects on Black and White Achievement: A Reexamination of the USOE Data." On Equality of Educational Opportunity, F. M. Mosteller and D. P. Moynihan, editors. New York: Random House, pp. 168-229.

Benrud, C. H., et al. (1977). Final Report on National Assessment of Educational Progress Sampling and Weighting Activities for Assessment Year 07. Raleigh, North Carolina: Research Triangle Institute.

Bowles, S. and H. M. Levin. (1968). "The Determinants of Scholastic Achievement: An Appraisal of Some Recent Evidence." Journal of Human Resources, 3 (Winter):3-24.

Bryant, E. C., et al. (1974). Associations Between Educational Outcomes and Background Variables. Denver, Colorado: National Assessment of Educational Progress.

Cain, G. G. and H. W. Watts. (1970). "Problems in Making Policy Inferences from the Coleman Report." American Sociological Review, 35:228-242.

Carver, R. P. (1975). "The Coleman Report: Using Inappropriately Designed Achievement Tests." American Educational Research Journal, 12 (Winter):77-86.

Coleman, J. S. (1972). "The Evaluation of Equality of Educational Opportunity." On Equality of Educational Opportunity, F. M. Mosteller and D. P. Moynihan, editors. New York: Random House, pp. 146-167.

Coleman, J. S. (1975). "Methods and Results in the IEA Studies of Effects of School on Learning." Review of Educational Research, 45 (Summer):355-386.

Coleman, J. S., et al. (1966). Equality of Educational Opportunity. U.S. Department of Health, Education and Welfare, Office of Education. Washington: Government Printing Office.

Comber, L. C. and J. P. Keeves. (1973). Science Education in Nineteen Countries, International Studies in Evaluation I. New York: John Wiley and Sons; Stocknolm: Almqvist and Wiksell.

Hanushek, E. A. and J. F. Kain. (1972). "On the Value of Equality of Educational Opportunity as a Guide to Public Policy." On Equality of Educational Opportunity, F. M. Mosteller and D. P. Moynihan, editors. New York: Random House, pp. 230-342.

Jencks, C. S. (1972a). "The Coleman Report and the Conventional Wisdom." On Equality of Educational Opportunity, F. M. Mosteller and D. P. Moynihan, editors. New York: Random House, pp. 69-116.

Jencks, C. S. (1972b). "The Quality of the Data Collected by the Equality of Educational Opportunity Survey." On Equality of Educational Opportunity, F. M. Mosteller and D. P. Moynihan, editors. New York: Random House, pp. 437-512.

Jencks, C. S. and M. D. Brown. (1975). "Effects of High Schools on Their Students." Harvard Educational Review, 45 (August):273-324.

Kalsbeek, W. D., et al. (1975). No Show Analysis. Raleigh, North Carolina: Research Triangle Institute.

Luecke, D. F. and N. F. McGinn. (1975). "Regression Analyses and Education Production Functions: Can They be Trusted?" Harvard Educational Review, 45 (August):325-350.

Magnusson, D. (1966). Test Theory. Reading, Massachusetts: Addison-Wesley.

Mayeske, G. W., et al. (1972). A Study of Our Nation's Schools. U.S. Department of Health, Education and Welfare, Office of Education. Washington: Government Printing Office.

Mayeske, G. W., et al. (1973a). A Study of Achievement of Our Nation's Students. U.S. Department of Health, Education and Welfare, Office of Education. Washington: Government Printing Office.

Mayeske, G. W., et al. (1973b). A Study of the Attitude Toward Life of Our Nation's Students. U.S. Department of Health, Education and Welfare, Office of Education. Washington: Government Printing Office.

Mosteller, F. M. and D. P. Moynihan. (1972). "A Pathbreaking Report." On Equality of Educational Opportunity, F. M. Mosteller and D. P. Moynihan, editors. New York: Random House, pp. 3-68.

Mosteller, F. M. and J. W. Tukey. (1977). Data Analysis and Regression. Reading, Massachusetts: Addison-Wesley.

National Assessment of Educational Progress. (1977a). Citizenship/Social Studies Released Exercise Set, 1975 to 1976 National Assessment of Citizenship/Social Studies. Denver, Colorado: Education Commission of the States.

National Assessment of Educational Progress. (1977b). Selected Supplemental Mathematics Exercises. Denver, Colorado: Education Commission of the States.

National Assessment of Educational Progress. (1978a). Changes in Political Knowledge and Attitudes, 1969-76, Report 07-CS-04. Washington: Government Printing Office.

National Assessment of Educational Progress. (1978b). Changes in Social Studies Performance 1972-76, Report 07-CS-05. Washington: Government Printing Office.

Peaker, G. F. (1975). An Empirical Study of Education in Twenty-One Countries: A Technical Report, International Studies in Evaluation VIII. New York: John Wiley and Sons; Stockholm: Almqvist and Wiksell.

Purves, A. C. (1973). Literature Education in Ten Countries, International Studies in Evaluation II. New York: John Wiley and Sons; Stockholm: Almqvist and Wiksell.

Rogers, W. T., et al. (1977). "Assessment of Non-Response Bias in Sample Surveys: An Example from National Assessment." Journal of Educational Measurement, 14 (Winter):297-311.

Smith, M. S. (1972). "Equality of Educational Opportunity: The Basic Findings Reconsidered." On Equality of Educational Opportunity, F. M. Mosteller and D. P. Moynihan, editors. New York: Random House, pp. 230-342.

Thorndike, R. L. (1973). Reading Comprehension Education in Fifteen Countries, International Studies in Evaluation III. New York: John Wiley and Sons; Stockholm: Almqvist and Wiksell.

Tukey, J. W. (1977). Exploratory Data Analysis. Reading, Massachusetts: Addison-Wesley.

Wiley, D. E. (1973). Another Hour, Another Day: Quantity of Schooling, A Potent Path for Policy. Mehr Licht! Studies of Educative Processes, Report No. 3. Chicago: University of Chicago.

Wiley, D. E. and A. Harnischfeger. (1974). "Explosion of a Myth: Quantity of Schooling and Exposure to Instruction, Major Educational Vehicles." Educational Researcher, 3(4):7-12.

APPENDIX

APPENDIX A

MOMENTS OF ACHIEVEMENT MEASURES

The first four moments of four achievement measures for mathematics are presented in Table 8. The corresponding information for political knowledge and socio-political attitudes is shown in Tables 9 and 10 respectively.

The first four moments are presented for the percentage acceptable and percentile rank measures of achievement, since these are intermediate results in the computation of the dependent variable. The first four moments for uncorrected logits of the percentile ranks are included only for purposes of comparison to the modified logits of the percentile ranks which was the measure actually used as the dependent variable for this study. (The number of respondents to each exercise booklet and the number of items in each booklet were shown in Tables 2 and 3.)

TABLE 8

MOMENTS OF ACHIEVEMENT MEASURES FOR MATHEMATICS

Achievement Measure	Exercise Booklet	Mean	Variance	Skewness	Kurtosis
Percentage Acceptable (as proportion)	1	0.656	0.0463	-0.406	-0.804
	2	0.668	0.0334	-0.522	-0.302
	Both	0.662	0.0401	-0.466	-0.572
Percentile Rank (as proportion)	1	0.500	0.0833	-0.001	-1.202
	2	0.500	0.0832	-0.001	-1.200
	Both	0.500	0.0832	-0.001	-1.201
Uniform Distribution		0.500	0.0833	0.000	-1.200
Logit of Percentile Rank (uncorrected)	1	-0.005	3.216	-0.077	0.828
	2	-0.003	3.236	-0.053	0.910
	Both	-0.004	3.225	-0.066	0.868
Modified Logit of Percentile Rank	1	0.000	3.272	-0.035	0.963
	2	0.000	3.276	-0.023	1.029
	Both	0.000	3.274	-0.029	0.995
Logistic Distribution		0.000	3.290	0.000	1.200

TABLE 9

MOMENTS OF ACHIEVEMENT MEASURES
FOR POLITICAL KNOWLEDGE

Achievement Measure	Exercise Booklet	Mean	Variance	Skewness	Kurtosis
Percentage Acceptable (as proportion)	3	0.693	0.0349	-0.626	0.102
	4	0.574	0.0333	-0.106	-0.368
	5	0.649	0.0384	-0.280	-0.537
	6	0.535	0.0338	-0.296	-0.380
	7	0.692	0.0267	-0.495	-0.106
	8	0.719	0.0285	-0.769	0.429
	9	0.707	0.0200	-0.446	-0.005
	10	0.530	0.0423	0.014	-0.517
	11	0.610	0.0445	-0.280	-0.444
	All	0.651	0.0357	-0.500	-0.143
Percentile Rank (as proportion)	3	0.500	0.0822	-0.009	-1.196
	4	0.500	0.0818	0.001	-1.190
	5	0.500	0.0823	-0.005	-1.202
	6	0.500	0.0823	-0.005	-1.199
	7	0.500	0.0829	-0.003	-1.199
	8	0.500	0.0822	-0.014	-1.198
	9	0.500	0.0830	-0.002	-1.199
	10	0.500	0.0825	0.000	-1.195
	11	0.500	0.0814	-0.010	-1.191
	All	0.500	0.0824	-0.005	-1.197
Uniform Distribution		0.500	0.0833	0.000	-1.200

TABLE 9 (Continued)

MOMENTS OF ACHIEVEMENT MEASURES
FOR POLITICAL KNOWLEDGE

Achievement Measure	Exercise Booklet	Mean	Variance	Skewness	Kurtosis
Logit of Percentile Rank (uncorrected)	3	-0.017	3.049	-0.199	0.569
	4	-0.004	3.078	-0.060	0.766
	5	-0.012	3.051	-0.168	0.585
	6	-0.005	3.131	-0.031	0.856
	7	-0.006	3.180	-0.092	0.769
	8	-0.015	3.078	-0.160	0.669
	9	-0.004	3.219	-0.052	0.973
	10	-0.002	3.131	-0.047	0.665
	11	-0.013	2.969	-0.157	0.439
	All	-0.008	3.125	-0.097	0.759
Modified Logit of Percentile Rank	3	0.000	3.205	-0.113	0.687
	4	0.000	3.213	-0.029	0.907
	5	0.000	3.209	-0.093	0.712
	6	0.000	3.236	-0.017	0.987
	7	0.000	3.256	-0.045	0.908
	8	0.000	3.215	-0.088	0.794
	9	0.000	3.269	-0.021	1.071
	10	0.000	3.239	-0.025	0.849
	11	0.000	3.171	-0.095	0.593
	All	0.000	3.233	-0.052	0.883
Logistic Distribution		0.000	3.290	0.000	1.200

TABLE 10

MOMENTS OF ACHIEVEMENT MEASURES
FOR SOCIO-POLITICAL ATTITUDES

Achievement Measure	Exercise Booklet	Mean	Variance	Skewness	Kurtosis
Percentage Acceptable (as proportion)	3	0.740	0.0651	-0.860	0.179
	4	0.620	0.0410	-0.443	-0.170
	5	0.701	0.0618	-0.488	-0.476
	6	0.693	0.0391	-0.964	0.365
	7	0.730	0.0240	-0.802	0.683
	8	0.690	0.0379	-0.582	0.133
	9	0.737	0.0232	-0.774	0.963
	10	0.677	0.0215	-0.492	0.235
	11	0.728	0.0254	-0.977	1.220
	All	0.700	0.0310	-0.712	0.689
Percentile Rank (as proportion)	3	0.500	0.0751	-0.133	-1.296
	4	0.500	0.0806	-0.018	-1.187
	5	0.500	0.0763	-0.063	-1.235
	6	0.500	0.0801	-0.039	-1.182
	7	0.500	0.0826	-0.008	-1.197
	8	0.500	0.0812	-0.014	-1.180
	9	0.500	0.0818	-0.013	-1.197
	10	0.500	0.0830	-0.002	-1.199
	11	0.500	0.0757	-0.119	-1.248
	All	0.500	0.0812	-0.023	-1.199
Uniform Distribution		0.500	0.0833	0.000	-1.200

TABLE 10 (Continued)

MOMENTS OF ACHIEVEMENT MEASURES
FOR SOCIO-POLITICAL ATTITUDES

Achievement Measure	Exercise Booklet	Mean	Variance	Skewness	Kurtosis
Logit of Percentile Rank (uncorrected)	3	-0.085	2.242	-0.692	0.019
	4	-0.017	2.934	-0.149	0.534
	5	-0.059	2.326	-0.553	0.091
	6	-0.028	2.900	-0.221	0.469
	7	-0.010	3.145	-0.119	0.770
	8	-0.025	2.922	-0.283	0.417
	9	-0.016	3.051	-0.187	0.686
	10	-0.004	3.214	-0.048	0.929
	11	-0.048	2.672	-0.317	1.048
	All	-0.019	3.003	-0.163	0.756
Modified Logit of Percentile Rank	3	0.000	2.724	-0.582	-0.117
	4	0.000	3.149	-0.093	0.672
	5	0.000	2.805	-0.439	-0.050
	6	0.000	3.127	-0.145	0.593
	7	0.000	3.242	-0.060	0.899
	8	0.000	3.145	-0.178	0.498
	9	0.000	3.200	-0.103	0.780
	10	0.000	3.267	-0.020	1.049
	11	0.000	2.969	-0.234	0.930
	All	0.000	3.166	-0.110	0.807
Logistic Distribution		0.000	3.290	0.000	1.200

APPENDIX B

SUMMARY OF EFFECTS FROM "METHODS AND RESULTS IN THE IEA STUDIES OF EFFECTS OF SCHOOL ON LEARNING," BY JAMES COLEMAN*

Even though an attempt was made to replicate the IEA studies and Coleman's methodology as applied to the data obtained in those studies, the comparison of results must be made primarily at a conceptual level. Specific comparisons are difficult because Coleman applied his procedure only to the IEA data for ten-year-olds and fourteen-year-olds. Also, since Coleman was working with the existing documentation of the IEA studies, he was able to compute only a few of the results he suggested obtaining. Therefore, figures comparable to many of the results produced in this study were not reported for science, literature or reading for any age group. Coleman's results are presented in Tables 11 and 12.

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*Review of Educational Research, Summer 1975, Vol. 45, No. 3, pp. 335-386.

TABLE 11

COLEMAN'S (1975:379) RESULTS
FOR IEA LITERATURE, READING AND SCIENCE STUDIES
AT AGE FOURTEEN, IN SIX COUNTRIES

Measures		Chile	England	Finland	Italy	Sweden	U.S.	Average
Total home background effects β_{41} $(=R_{41})$	Literature	.38	.50	.43	.33	.39	.43	.41
	Reading	.45	.52	.45	.32	.40	.47	.44
	Science	.36	.48	.47	.32	.42	.47	.42
	Average	.40	.50	.45	.32	.41	.46	.42
Direct school effects $\beta_{43\cdot12}$	Literature	.32	.22	.26	.18	.26	.30	.26
	Reading	.28	.19	.23	.19	.18	.28	.23
	Science	.26	.30	.34	.26	.28	.28	.29
	Average	.28	.25	.28	.21	.24	.29	.26
School effects distributed independently of home and school type $\beta_{43\cdot12}\sqrt{1 - R_{3(12)}^2}$ $\left(=\sqrt{R_{123}^2 - R_{12}^2}\right)$	Literature	.26	.20	.24	.17	.25	.28	.23
	Reading	.26	.16	.21	.18	.17	.26	.21
	Science	.25	.27	.32	.25	.27	.27	.27
	Average	.26	.21	.26	.20	.23	.27	.24
Ratio of direct school effects to total home background effects $\frac{\beta_{43\cdot12}}{\beta_{41}}$	Literature	.84	.44	.60	.55	.67	.70	.63
	Reading	.62	.37	.51	.59	.45	.60	.52
	Science	.72	.63	.72	.81	.67	.60	.69
	$\frac{\text{av } \beta_{43\cdot12}}{\text{av } \beta_{41}}$	.65	.50	.62	.66	.59	.63	.62

TABLE 12

COLEMAN'S (1975:380) RESULTS
FOR IEA READING AND SCIENCE STUDIES
AT AGE TEN, IN SIX COUNTRIES

Measures		Chile	England	Finland	Italy	Sweden	U.S.	Average
Total home background effects β_{41} (=R_{41})	Reading	.12	.47	.42	.31	.34	.45	.35
	Science	.20	.46	.37	.20	.40	.42	.34
	Average	.16	.46	.40	.26	.37	.44	.35
Direct school effects $\beta_{43\cdot12}$	Reading	.29	.13	.18	.22	.18	.21	.20
	Science	.30	.18	.21	.20	.23	.32	.24
	Average	.30	.16	.19	.21	.21	.26	.22
School effects distributed independently of home and school type $\beta_{43\cdot12}\sqrt{1 - R_{3(12)}^2}\Big/\left(\sqrt{R_{123}^2 - R_{12}^2}\right)$	Reading	.29	.12	.17	.21	.17	.20	.19
	Science	.30	.17	.20	.20	.22	.30	.23
	Average	.30	.15	.15	.21	.20	.25	.21
Ratio of direct school effects to total home background effects $\frac{\beta_{43\cdot12}}{\beta_{41}}$	Reading	2.42	.28	.43	.71	.53	.47	.57
	Science	1.50	.39	.57	1.00	.58	.76	.71
	$\frac{\text{av } \beta_{43\cdot12}}{\text{av } \beta_{41}}$	1.88	.35	.48	.81	.57	.59	.63

APPENDIX C

REGRESSION RESULTS FOR MATHEMATICS, POLITICAL KNOWLEDGE AND POLITICAL ATTITUDES

The overall results for the series of regressions of mathematics acievement on the block 1, 2 and 3 variables are presented in Table 13. The simple correlation coefficients, the multiple regression coefficients and the F-ratios for the regression of mathematics achievement on the variables in each of the three blocks are included in Tables 14, 15 and 16. The F-ratios shown in these tables are "partial," not "sequential" or "hierarchical" F-ratios; they test the significance of each variable as if it had been the last one added to the equation. The standardized regression coefficients for the interval variables in all mathematics blocks are included in Table 17.

The regression results for the three blocks of variables for political knowledge are presented in Tables 18 through 22. Tables 23 through 27 contain the regression results for the three blocks of variables for political attitudes.

TABLE 13

SUMMARY OF MATHEMATICS REGRESSION RESULTS

N = 10,014

	Blocks Included in Regression		
	Block 1	Blocks 1 and 2	Blocks 1, 2 and 3
Standardized Regression Coefficients			
Block 1 (Home Background)	0.523	0.396	0.293
Block 2 (Type of School and Community)		0.331	0.184
Block 3 (School Resources)			0.482
Correlations between Blocks			
Block 1 with Block 2		0.367	0.400
Block 1 with Block 3			0.224
Block 2 with Block 3			0.376
Blocks 1 and 2 with Block 3			0.384
Percent of Total Variance Explained			
By all Blocks included	27.3%	36.3%	52.5%
Uniquely by Block 1	27.3%	13.6%	7.1%
Uniquely by Block 2		9.5%	2.5%
Uniquely by Block 3			19.8%
Jointly by all Blocks	0.0%	13.2%	22.9%

TABLE 14

REGRESSION RESULTS FOR MATHEMATICS BLOCK 1 (HOME BACKGROUND)

N = 10,014

Regression Coefficients and F-Ratios (on second line)

Name of Variable	Simple Correlation	Blocks Included in Regression: Block 1	Blocks 1 and 2	Blocks 1, 2 and 3
Both Parents Unknown Educ.	-0.204	-1.112	-0.813	-0.421
		364	215	76
One Parent Not Grad. H.S.	-0.178	-0.911	-0.585	-0.313
		366	162	61
Both Parents Grad. H.S.	0.103	-0.555	-0.367	-0.174
		155	75	22
Reading Materials Index	0.284	0.235	0.192	0.064
		133	101	15
Family Size	-0.158	-0.038	-0.028	---
		24	15	
Age in Months	0.035	0.019	0.018	-0.009
		17	17	5
Female	-0.108	-0.468	-0.468	-0.527
		226	257	405
Black	-0.321	-1.441	-1.097	-1.080
		647	293	392
Hispanic	-0.160	-0.734	-0.547	-0.457
		74	42	40
Other Non-White Race	0.002	0.235	0.497	0.337
		5	20	12
Non-English	-0.137	-0.475	-0.455	-0.283
		36	38	19
Bilingual	-0.077	-0.487	-0.434	-0.303
		30	27	17
Hours of TV Watched	-0.164	-0.082	-0.060	-0.033
		78	47	19
Specific Study Place	0.057	-0.115	-0.144	-0.188
		12	22	50
Typewriter	0.218	0.318	0.238	0.113
		63	40	12
Dishwasher	0.261	0.251	0.145	0.087
		50	18	9
Record Player	0.133	0.342	0.296	0.248
		31	26	25
Color TV	0.099	-0.166	-0.169	-0.103
		16	19	9

TABLE 15

REGRESSION RESULTS FOR MATHEMATICS BLOCK 2
(TYPE OF SCHOOL AND COMMUNITY)

N = 10,014

Name of Variable	Simple Correlation	Regression Coefficients and F-Ratios (on second line) Blocks Included in Regression: Block 2	Blocks 1 and 2	Blocks 1, 2 and 3
Academic Program	0.389	1.273 1330	1.078 1143	0.489 267
Occupational Program	-0.177	-0.269 33	---	---
Large City Percent*	-0.059	---	0.222 28	---
Inner-Suburban Index*	-0.140	-0.232 16	---	---
Rural-Urban Index*	-0.078	0.351 37	0.181 10	0.127 7
SES Index*	-0.274	-0.951 134	-0.380 23	-0.175 7
Northeast	0.034	---	-0.139 14	-0.201 39
Southeast	-0.116	-0.211 25	-0.123 9	-0.105 9
Percent White in School*	0.291	1.328 272	0.680 56	0.627 65
School Title I Eligible	-0.052	0.195 21	0.142 13	0.095 8
Percent Students Eligible*	-0.210	-0.984 47	-0.601 20	-0.503 19

*Coefficients for these variables are given for the variable expressed as a proportion rather than as a percent. The coefficients are smaller by a factor of one hundred if the variable is given as a percent.

TABLE 16

REGRESSION RESULTS FOR MATHEMATICS BLOCK 3
(SCHOOL RESOURCES)

N = 10,014

Name of Variable	Simple Correlation	Regression Coefficients and F-Ratios (on second line) Blocks Included in Regression: Block 3	Blocks 1, 2 and 3
Grade 10 or Lower	-0.302	-0.816 389	-0.857 221
Grade 11	0.176	---	-0.221 24
No Homework Assigned	-0.160	-0.343 32	-0.277 25
Hours of Homework	0.208	---	0.018 13
Traditional Methods	0.222	0.094 57	0.059 28
Progressive Methods	0.248	0.048 47	0.025 16
Basic Courses Taken	0.385	0.419 357	0.310 245
Advanced Courses Taken	0.464	0.721 1142	0.561 790
Used Calculator	0.233	0.398 126	0.207 43
Studied Sets	0.290	0.617 173	0.594 203
Studied Functions	0.301	0.359 117	0.237 64
Studied Metric System	0.231	0.308 91	0.228 63

TABLE 17

REGRESSION RESULTS FOR MATHEMATICS--ALL BLOCKS

Standardized Regression Coefficients for Variables Other than Dummies

N = 10,014

	Blocks Included in Regression		
Block 1 Variables	Block 1	Blocks 1 and 2	Blocks 1, 2 and 3
Reading Materials Index	0.111	0.091	0.030
Family Size	-0.043	-0.032	---
Age in Months	0.035	0.034	-0.018
Hours of TV Watched	-0.077	-0.056	-0.031
Block 2 Variables	**Block 2**	**Blocks 1 and 2**	**Blocks 1, 2 and 3**
Large City Percent	---	0.046	---
Inner-Suburban Index	-0.039	---	---
Rural-Urban Index	0.060	0.031	0.022
SES Index	-0.128	-0.051	-0.024
Percent White in School	0.174	0.089	0.082
Percent Students Eligible	-0.089	-0.054	-0.045
Block 3 Variables	**Block 3**		**Blocks 1, 2 and 3**
Hours of Homework	---		0.029
Traditional Methods	0.064		0.040
Progressive Methods	0.059		0.031
Basic Courses Taken	0.164		0.121
Advanced Courses Taken	0.293		0.228

TABLE 18

SUMMARY OF POLITICAL KNOWLEDGE REGRESSION RESULTS

N = 22,470

	Blocks Included in Regression		
	Block 1	Blocks 1 and 2	Blocks 1, 2 and 3
Standardized Regression Coefficients			
Block 1 (Home Background)	0.418	0.335	0.269
Block 2 (Type of School and Community)		0.247	0.173
Block 3 (School Resources)			0.313
Correlations between Blocks			
Block 1 with Block 2		0.324	0.315
Block 1 with Block 3			0.233
Block 2 with Block 3			0.324
Blocks 1 and 2 with Block 3			0.352
Percent of Total Variance Explained			
By all Blocks included	17.5%	22.7%	30.4%
Uniquely by Block 1	17.5%	10.1%	6.4%
Uniquely by Block 2		5.5%	2.5%
Uniquely by Block 3			8.6%
Jointly by all Blocks	0.0%	7.2%	13.0%

TABLE 19

REGRESSION RESULTS FOR POLITICAL KNOWLEDGE BLOCK 1
(HOME BACKGROUND)

N = 22,470

Regression Coefficients and F-Ratios (on second line)

Name of Variable	Simple Correlation	Blocks Included in Regression: Block 1	Blocks 1 and 2	Blocks 1, 2 and 3
Both Parents Unknown Educ.	-0.175	-0.909	-0.708	-0.549
		488	313	207
One Parent Not Grad. H.S.	-0.137	-0.673	-0.446	-0.360
		408	189	135
Both Parents Grad. H.S.	0.069	-0.479	-0.335	-0.274
		236	121	89
Reading Materials Index	0.274	0.289	0.244	0.152
		401	302	127
Family Size	-0.172	-0.065	-0.057	-0.042
		138	114	68
Birth Order	-0.045	-0.266	-0.212	-0.166
		24	16	11
Age in Months	0.065	0.030	0.026	---
		90	72	
Female	-0.089	-0.340	-0.337	-0.447
		239	251	465
Black	-0.182	-0.556	-0.445	-0.457
		196	94	109
Hispanic	-0.116	-0.299	-0.276	-0.303
		23	20	27
Other Non-White Race	-0.055	-0.414	-0.293	-0.464
		29	13	36
Non-English	-0.145	-0.619	-0.601	-0.404
		110	110	54
Bilingual	-0.053	-0.264	-0.267	-0.226
		20	21	17
Hours of TV Watched	-0.138	-0.077	-0.059	-0.036
		139	85	35
Typewriter	0.183	0.285	0.228	0.130
		101	69	25
Dishwasher	0.192	0.105	---	---
		19		
Record Player	0.111	0.242	0.217	0.201
		25	21	20

TABLE 20

REGRESSION RESULTS FOR POLITICAL KNOWLEDGE BLOCK 2
(TYPE OF SCHOOL AND COMMUNITY)

N = 22,470

Regression Coefficients and F-Ratios (on second line)

Name of Variable	Simple Correlation	Blocks Included in Regression: Block 2	Blocks 1 and 2	Blocks 1, 2 and 3
Academic Program	0.303	1.373	1.033	0.719
		1863	1100	556
General Program	-0.117	0.460	0.314	0.231
		224	113	68
Medium City Percent*	0.071	0.120	---	---
		21		
Small Place Percent*	-0.046	---	-0.133	-0.083
			20	9
Inner-Suburban Index*	-0.044	---	0.154	0.166
			16	20
Rural-Urban Index*	-0.069	0.267	0.304	0.194
		33	39	18
SES Index*	-0.198	-0.776	-0.421	-0.296
		193	61	33
Northeast	0.024	---	-0.121	-0.075
			21	9
Central	0.033	0.116	---	---
		17		
West	-0.002	0.089	---	---
		10		
Percent White in School*	0.186	0.943	0.274	0.262
		278	15	15

*Coefficients for these variables are given for the variable expressed as a proportion rather than as a percent. The coefficients are smaller by a factor of one hundred if the variable is given as a percent.

TABLE 21

REGRESSION RESULTS FOR POLITICAL KNOWLEDGE BLOCK 3
(SCHOOL RESOURCES)

N = 22,470

Name of Variable	Simple Correlation	Regression Coefficients and F-Ratios (on second line) Blocks Included in Regression: Block 3	Blocks 1, 2 and 3
Grade 10 or Lower	-0.275	-1.351 954	-1.014 588
Grade 11	0.144	-0.457 163	-0.439 172
No Homework Assigned	-0.116	-0.156 8	---
Hours of Homework	0.194	0.050 161	0.042 130
Traditional Methods	0.229	0.175 347	0.126 204
Progressive Methods	0.248	0.082 228	0.046 83
No Courses Taken	-0.164	-0.460 99	-0.403 87
1 or 2 Courses Taken	-0.040	-0.085 14	-0.088 17
Studied: Analyze Values	0.211	0.291 245	0.211 121
Studied: Acquire Info.	0.156	---	0.059 9
Discussion Frequency	0.189	0.141 90	0.118 72
School Climate Scale	0.157	0.062 179	0.031 49

TABLE 22

REGRESSION RESULTS FOR POLITICAL KNOWLEDGE--ALL BLOCKS

Standardized Regression Coefficients for
Variables Other than Dummies

N = 22,470

	Blocks Included in Regression		
Block 1 Variables	Block 1	Blocks 1 and 2	Blocks 1, 2 and 3
Reading Materials Index	0.136	0.115	0.071
Family Size	-0.074	-0.066	-0.048
Birth Order	-0.030	-0.024	-0.019
Age in Months	0.058	0.050	---
Hours of TV Watched	-0.073	-0.056	-0.034
Block 2 Variables	**Block 2**	**Blocks 1 and 2**	**Blocks 1, 2 and 3**
Medium City Percent	0.031	---	---
Small Place Percent	---	-0.033	0.021
Inner-Suburban Index	---	0.025	0.027
Rural-Urban Index	0.045	0.051	0.032
SES Index	-0.112	-0.061	-0.043
Percent White in School	0.116	0.034	0.032
Block 3 Variables	**Block 3**		**Blocks 1, 2 and 3**
Hours of Homework	0.083		0.069
Traditional Methods	0.121		0.087
Progressive Methods	0.102		0.058
Studied: Analyze Values	0.103		0.075
Studied: Acquire Info.	---		0.020
Discussion Frequency	0.062		0.052
School Climate Scale	0.082		0.041

TABLE 23

SUMMARY OF SOCIO-POLITICAL ATTITUDES REGRESSION RESULTS

N = 22,470

	Blocks Included in Regression		
	Block 1	Blocks 1 and 2	blocks 1, 2 and 3
Standardized Regression Coefficients			
Block 1 (Home Background)	0.358	0.302	0.221
Block 2 (Type of School and Community)		0.191	0.120
Block 3 (School Resources)			0.307
Correlations between Blocks			
Block 1 with Block 2		0.278	0.279
Block 1 with Block 3			0.300
Block 2 with Block 3			0.305
Blocks 1 and 2 with Block 3			0.378
Percent of Total Variance Explained			
By all Blocks included	12.8%	16.0%	23.5%
Uniquely by Block 1	12.8%	8.4%	4.3%
Uniquely by Block 2		3.4%	1.2%
Uniquely by Block 3			8.1%
Jointly by all Blocks	0.0%	4.2%	10.0%

TABLE 24

REGRESSION RESULTS FOR SOCIO-POLITICAL ATTITUDES BLOCK 1 (HOME BACKGROUND)

N = 22,470

		Regression Coefficients and F-Ratios (on second line)		
	Simple	Blocks Included in Regression		
Name of Variable	Correlation	Block 1	Blocks 1 and 2	Blocks 1, 2 and 3
Both Parents Unknown Educ.	-0.159	-0.822	-0.669	-0.511
		394	265	168
One Parent Not Grad. H.S.	-0.086	-0.527	-0.338	-0.262
		261	106	70
Both Parents Grad. H.S.	0.045	-0.400	-0.282	-0.217
		162	82	53
Reading Materials Index	0.239	0.281	0.247	0.165
		371	294	142
Family Size	-0.118	-0.041	-0.034	-0.022
		54	37	18
Age in Months	0.052	0.023	0.020	---
		51	39	
Female	0.125	0.414	0.414	0.317
		343	355	217
Black	-0.112	-0.240	-0.078	-0.121
		35	3	7
Hispanic	-0.057	0.184	0.136	0.114
		8	4	3
Other Non-White Race	-0.063	-0.433	-0.334	-0.486
		33	16	38
Non-English	-0.127	-0.631	-0.608	-0.449
		113	108	64
Bilingual	-0.030	-0.157	-0.144	-0.138
		7	6	6
Hours of TV Watched	-0.123	-0.066	-0.054	-0.036
		98	67	33
Specific Study Place	0.104	0.179	0.146	---
		60	41	
Typewriter	0.165	0.228	0.180	0.115
		63	41	18
Record Player	0.113	0.261	0.245	0.298
		29	26	43

TABLE 25

REGRESSION RESULTS FOR SOCIO-POLITICAL ATTITUDES BLOCK 2
(TYPE OF SCHOOL AND COMMUNITY)

N = 22,470

Regression Coefficients and F-Ratios (on second line)

Name of Variable	Simple Correlation	Blocks Included in Regression: Block 2	Blocks 1 and 2	Blocks 1, 2 and 3
Academic Program	0.242	1.279 568	0.808 642	0.488 242
General Program	-0.096	0.552 108	0.277 85	0.177 38
Occupational Program	-0.129	0.268 21	---	---
Large City Percent*	-0.002	---	0.116 15	0.042 2
Inner-Suburban Index*	-0.063	-0.171 16	---	---
SES Index*	-0.141	-0.379 57	---	---
Southeast	-0.060	-0.110 13	---	---
West	0.019	0.100 12	0.186 49	0.168 43
Percent White in School*	0.134	0.698 121	0.395 34	0.309 23

*Coefficients for these variables are given for the variable expressed as a proportion rather than as a percent. The coefficients are smaller by a factor of one hundred if the variable is given as a percent.

TABLE 26

REGRESSION RESULTS FOR SOCIO-POLITICAL ATTITUDES BLOCK 3
(SCHOOL RESOURCES)

N = 22,470

Regression Coefficients and F-Ratios (on second line)

Name of Variable	Simple Correlation	Blocks Included in Regression: Block 3	Blocks 1, 2 and 3
Grade 10 or Lower	-0.216	-0.882 412	-0.546 161
Grade 11	0.122	-0.266 55	-0.241 48
Hours of Homework	0.225	0.074 383	0.051 181
Traditional Methods	0.225	0.160 287	0.110 143
Progressive Methods	0.269	0.104 374	0.073 191
No Courses Taken	-0.160	-0.529 126	-0.416 84
1 or 2 Courses Taken	-0.052	-0.121 28	-0.130 34
Studied: Analyze Values	0.202	0.222 115	0.205 106
Studied: Acquire Info.	0.172	0.129 36	0.156 56
Discussion Frequency	0.181	0.108 51	0.112 59
School Climate Scale	0.128	0.041 80	0.019 19

TABLE 27

REGRESSION RESULTS FOR SOCIO-POLITICAL ATTITUDES--ALL BLOCKS

Standardized Regression Coefficients for
Variables Other than Dummies

N = 22,470

	Blocks Included in Regression		
Block 1 Variables	Block 1	Blocks 1 and 2	Blocks 1, 2 and 3
Reading Materials Index	0.134	0.118	0.079
Family Size	-0.048	-0.039	-0.026
Age in Months	0.045	0.038	---
Hours of TV Watched	-0.063	-0.051	-0.034
Block 2 Variables	**Block 2**	**Blocks 1 and 2**	**Blocks 1, 2 and 3**
Large City Percent	---	0.025	0.009
Inner-Suburban Index	-0.028	---	---
SES Index	-0.054	---	---
Percent White in School	0.084	0.047	0.037
Block 3 Variables	**Block 3**		**Blocks 1, 2 and 3**
Hours of Homework	0.125		0.086
Traditional Methods	0.111		0.076
Progressive Methods	0.131		0.092
Studied: Analyze Values	0.079		0.073
Studied: Acquire Info.	0.043		0.052
Discussion Frequency	0.048		0.050
School Climate Scale	0.056		0.026

APPENDIX D

MEAN AND VARIANCE OF INDEPENDENT VARIABLES

The mean and variance of each independent variable for the mathematics analysis are shown in Table 28. The same information for the political knowledge and socio-political attitudes analyses is presented in Tables 29 and 30.

As discussed, a different sample was used for mathematics than for the other two subject matters. The slight differences in the distributions of the independent variables for political knowledge and socio-political attitudes are due to the fact that respondents were weighted by the number of items attempted for the subject matter being analyzed.

TABLE 28

MEAN AND VARIANCE OF INDEPENDENT VARIABLES
FOR MATHEMATICS

N = 10,014

Block 1 Variables	Mean	Variance
Both Parents Unknown Educ.	0.141	0.121
One Parent Not Grad. H.S.	0.324	0.219
Both Parents Grad. H.S.	0.337	0.224
Both Parents Post H.S.	0.198	0.159
Reading Materials Index	4.474	0.728
Family Size	4.228	4.345
Birth Order	0.509	0.039
Only Child	0.031	0.030
Age in Months	6.280	11.999
Female	0.506	0.250
White	0.840	0.134
Black	0.095	0.086
Hispanic	0.042	0.041
Other Non-White Race	0.023	0.022
English	0.919	0.074
Non-English	0.048	0.046
Bilingual	0.033	0.032
Hours of TV Watched	1.544	2.885
Specific Study Place	0.552	0.247
Typewriter	0.724	0.200
Dishwasher	0.438	0.246
Record Player	0.900	0.090
Tape Recorder	0.800	0.160
Color TV	0.759	0.183
Two Cars that Run	0.735	0.195

TABLE 28 (Continued)

MEAN AND VARIANCE OF INDEPENDENT VARIABLES
FOR MATHEMATICS

Block 2 Variables	Mean	Variance
Academic Program	0.368	0.233
General Program	0.413	0.242
Industrial Program	0.068	0.063
Occupational Program	0.150	0.128
Large City Percent*	0.181	0.143
Medium City Percent*	0.437	0.212
Small Place Percent*	0.382	0.203
Inner-Suburban Index*	-0.015	0.092
Rural-Urban Index*	-0.695	0.096
SES Index*	0.070	0.060
Southeast	0.201	0.161
Northeast	0.260	0.193
Central	0.274	0.199
West	0.264	0.195
Percent White in School*	0.819	0.056
School Title I Eligible	0.462	0.249
Percent Students Eligible*	0.095	0.027

Block 3 Variables	Mean	Variance
Grade 10 or Lower	0.152	0.129
Grade 11	0.742	0.191
Grade 12	0.105	0.094
No Homework Assigned	0.062	0.058
Hours of Homework	4.048	8.674
Traditional Methods	6.689	1.518
Progressive Methods	9.461	4.795
Basic Courses Taken	2.190	0.499
Advanced Courses Taken	0.602	0.541
Used Calculator	0.778	0.172
Studied Sets	0.876	0.109
Studied Functions	0.677	0.219
Studied Metric System	0.690	0.214

*Mean and variance for these variables are given for the variable expressed as a proportion rather than as a percent.

TABLE 29

MEAN AND VARIANCE OF INDEPENDENT VARIABLES FOR POLITICAL KNOWLEDGE

N = 22,470

Block 1 Variables	Mean	Variance
Both Parents Unknown Educ.	0.137	0.118
One Parent Not Grad. H.S.	0.329	0.221
Both Parents Grad. H.S.	0.325	0.219
Both Parents Post H.S.	0.209	0.165
Reading Materials Index	4.487	0.716
Family Size	4.241	4.279
Birth Order	0.513	0.041
Only Child	0.028	0.027
Age in Months	6.259	12.078
Female	0.508	0.250
White	0.841	0.134
Black	0.097	0.088
Hispanic	0.040	0.038
Other Non-White Race	0.022	0.021
English	0.920	0.073
Non-English	0.043	0.041
Bilingual	0.037	0.036
Hours of TV Watched	1.559	2.896
Specific Study Place	0.577	0.244
Typewriter	0.764	0.180
Dishwasher	0.465	0.249
Record Player	0.939	0.057
Tape Recorder	0.837	0.137
Color TV	0.791	0.166
Two Cars that Run	0.771	0.177

TABLE 29 (Continued)

MEAN AND VARIANCE OF INDEPENDENT VARIABLES FOR POLITICAL KNOWLEDGE

Block 2 Variables	Mean	Variance
Academic Program	0.366	0.232
General Program	0.440	0.246
Industrial Program	0.050	0.047
Occupational Program	0.144	0.123
Large City Percent*	0.190	0.148
Medium City Percent*	0.432	0.211
Small Place Percent*	0.378	0.203
Inner-Suburban Index*	-0.024	0.085
Rural-Urban Index*	-0.702	0.090
SES Index*	-0.078	0.067
Southeast	0.210	0.166
Northeast	0.254	0.189
Central	0.270	0.197
West	0.266	0.195
Percent White in School*	0.825	0.049
School Title I Eligible	0.472	0.249
Percent Students Eligible*	0.098	0.029

Block 3 Variables	Mean	Variance
Grade 10 or Lower	0.163	0.136
Grade 11	0.732	0.196
Grade 12	0.105	0.094
No Homework Assigned	0.048	0.046
Hours of Homework	4.140	8.972
Traditional Methods	6.764	1.547
Progressive Methods	9.499	5.015
No Courses Taken	0.070	0.065
1 or 2 Courses Taken	0.488	0.250
3 or More Courses Taken	0.442	0.247
Studied: Analyze Values	1.787	0.403
Studied: Acquire Info.	1.782	0.358
Discussion Frequency	2.137	0.633
School Climate Scale	4.788	5.638

*Mean and variance for these variables are given for the variables expressed as a proportion rather than as a percent.

TABLE 30

MEAN AND VARIANCE OF INDEPENDENT VARIABLES
FOR SOCIO-POLITICAL ATTITUDES

N = 22,470

Block 1 Variables	Mean	Variance
Both Parents Unknown Educ.	0.136	0.117
One Parent Not Grad. H.S.	0.332	0.222
Both Parents Grad. H.S.	0.324	0.219
Both Parents Post H.S.	0.208	0.165
Reading Materials Index	4.486	0.720
Family Size	4.244	4.298
Birth Order	0.514	0.040
Only Child	0.028	0.027
Age in Months	6.258	12.047
Female	0.512	0.250
White	0.844	0.132
Black	0.094	0.085
Hispanic	0.039	0.038
Other Non-White Race	0.023	0.022
English	0.920	0.074
Non-English	0.044	0.042
Bilingual	0.036	0.035
Hours of TV Watched	1.555	2.892
Specific Study Place	0.579	0.244
Typewriter	0.764	0.180
Dishwasher	0.465	0.249
Record Player	0.938	0.058
Tape Recorder	0.833	0.139
Color TV	0.792	0.165
Two Cars that Run	0.772	0.176

TABLE 30 (Continued)

MEAN AND VARIANCE OF INDEPENDENT VARIABLES
FOR SOCIO-POLITICAL ATTITUDES

Block 2 Variables	Mean	Variance
Academic Program	0.365	0.232
General Program	0.438	0.246
Industrial Program	0.052	0.049
Occupational Program	0.145	0.124
Large City Percent*	0.182	0.143
Medium City Percent*	0.434	0.211
Small Place Percent*	0.385	0.205
Inner-Suburban Index*	-0.026	0.083
Rural-Urban Index*	-0.704	0.089
SES Index*	-0.080	0.065
Southeast	0.217	0.170
Northeast	0.253	0.189
Central	0.267	0.196
West	0.263	0.194
Percent White in School*	0.830	0.046
School Title I Eligible	0.479	0.250
Percent Students Eligible*	0.097	0.027

Block 3 Variables	Mean	Variance
Grade 10 or Lower	0.166	0.138
Grade 11	0.729	0.198
Grade 12	0.105	0.094
No Homework Assigned	0.051	0.048
Hours of Homework	4.159	9.013
Traditional Methods	6.772	1.516
Progressive Methods	9.518	5.009
No Courses Taken	0.067	0.063
1 or 2 Courses Taken	0.484	0.250
3 or More Courses Taken	0.449	0.247
Studied: Analyze Values	1.791	0.401
Studied: Acquire Info.	1.782	0.350
Discussion Frequency	2.165	0.620
School Climate Scale	4.800	5.703

*Mean and variance for these variables are given for the variable expressed as a proportion rather than as a percent.